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LIQUID METAL DROP EJECTION

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by

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The aim of this project was to demonstrate the possibility of ejecting liquid metals using drop on demand printing technology. The plan was to make transducers for operation in the 100 MHz frequency range and to use these transducers to demonstrate the ability to eject drops of liquid metals such as gallium.

Two transducers were made by indium bonding piezoelectric lithium niobate to quartz buffer rods. The lithium niobate plates were thinned by mechanical polishing to a thickness of 37 μm for operation at 100 MHz. Hemispherical lenses were polished in the opposite ends of the buffer rods. The lenses, which focus the sound waves in the liquid metal, had an F-number =1. A mechanical housing was made to hold the transducers and to allow precise control over the liquid level above the lens.

We started by demonstrating the ability to eject drops of water on demand. The drops of water had a diameter of 15 μm which corresponds to the wavelength of the sound wave in the water. A videotape of this ejection was made and delivered to Dr. R. Oftering the technical contract monitor. Dr. Oftering visited our laboratory and was shown the ejection system. One transducer and housing were given to Dr. Oftering so that he could reproduce the experiment in his laboratory.

We then used a mixture of Gallium and Indium (used to lower the melting temperature of the Gallium) to demonstrate the ejection of liquid metal drops. This proved to be difficult because of the oxide skin which forms on the surface of the liquid. In some instances, we were able to eject metal drops, however, this was not consistent and reproducible

An experiment was set up by Dr. Oftering at NASA-Lewis to stabilize the process of drop on demand liquid metal ejection. The object was to place the transducer and liquid metal in a

vacuum station so that no oxide would form on the surface. This experiment was successful, though the second transducer needed to be sent to Dr. Oftering as the first transducer expired.

In summary, we were successful in demonstrating that liquid metals could be ejected on demand and that this technology could be used for making sheet metal in space.

NO EQUIPMENT WAS PURCHASED FOR THIS GRANT.

NO PATENTS WERE FILED AS A RESULT OF THIS WORK.